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Association between Iron and Folic Acid Supplementation Adherence and Anemia among Adolescent Girls in Kulon Progo, Indonesia

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ABSTRACT

Introduction: Iron deficiency anemia remains a major public health concern among adolescent girls, particularly in low- and middle-income countries. Although iron and folic acid supplementation (IFAS) programs have been widely implemented in Indonesia, anemia prevalence remains high, suggesting potential challenges in adherence.
Objective: This study aimed to examine the association between IFAS adherence and anemia among adolescent girls in Kulon Progo, Indonesia.
Methods: A cross-sectional study was conducted between November 2024 and February 2025 among 71 female students aged 15–18 years selected through proportional random sampling. IFAS adherence was assessed using a structured questionnaire and categorized as adherent (≥4 tablets/month) or non-adherent (<4 tablets/month) based on national guidelines. Hemoglobin levels were measured using the Easy Touch GCHb device, and anemia was defined as hemoglobin <12 g/dL. Data were analyzed using the Chi-square test, with statistical significance set at $p < 0.05$.
Results: The majority of participants were classified as non-adherent to IFAS (93.0%). Overall, 56.3% of respondents were anemic. A statistically significant association was observed between IFAS adherence and anemia status ($p = 0.008$). Non-adherent participants exhibited a substantially higher proportion of anemia compared with adherent participants.
Conclusion: Low adherence to iron supplementation was significantly associated with anemia among adolescent girls. Strengthening adherence-focused interventions, including nutrition education and school-based support strategies, is essential to enhance the effectiveness of anemia prevention programs in this population.

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INTRODUCTION

Anemia is a condition characterized by reduced hemoglobin concentrations in red blood cells (Rahayu et al., 2019). The World Health Organization (WHO) defines anemia based on hemoglobin thresholds adjusted for age, sex, and pregnancy status. Women aged ≥15 years are classified as non-anemic when hemoglobin levels exceed 12.0 g/dL (World Health Organization, 2011). Given its substantial prevalence, anemia represents a significant public health concern rather than a negligible clinical condition.

In Indonesia, approximately half of the population is affected by anemia, underscoring its seriousness as a national health issue requiring targeted intervention. Data from the 2018 Basic Health Research Survey (Riskesdas) indicate that anemia prevalence reached 26.8% among children aged 5–14 years and 32% among adolescents aged 15–24 years (Kemenkes RI, 2022). A regional survey conducted by the Yogyakarta Special Region Health Office in 2018 involving 1,500 adolescent girls across five districts reported an anemia prevalence of 19.3%. Kulon Progo District exhibited the highest prevalence at 34.75%, reflecting a 20.88% increase compared with previous data (13.87%) (Dinkes DIY, 2018). These findings highlight the urgent need for further investigation as a strategic approach to anemia prevention in Kulon Progo, enabling the development of evidence-based interventions aimed at reducing prevalence rates (Sari & Khristiani, 2024)

To address anemia, local governments have implemented multiple strategies, including the iron and folic acid supplementation (IFAS) program. In 2018, Sleman District reported the lowest coverage of iron supplementation among adolescent girls (28.08%) across the Yogyakarta Special Region, whereas Kulon Progo achieved the highest coverage (86.28%) (Afianti, 2022). Despite this relatively high program coverage, anemia prevalence in Kulon Progo remains elevated, suggesting potential gaps in adherence or program effectiveness. The school-based iron supplementation program targets adolescent girls in junior and senior high schools, as well as out-of-school females, as part of the national strategy to prevent and control anemia among adolescent girls and women of reproductive age. One key objective of the program is to promote consistent iron tablet consumption to reduce anemia prevalence (Kemenkes RI, 2018).

Regular iron supplementation for three consecutive months has been shown to significantly increase hemoglobin levels and improve cognitive concentration among adolescent girls (Putriwati, Purwaningtyas dan Iswahyudi, 2024). Similarly, Tonasih et al. (2019) reported improvements in hemoglobin concentrations among female students who received weekly iron supplementation at STIKes Muhammadiyah Cirebon. Nevertheless, despite ongoing supplementation programs, anemia prevalence among adolescent girls remains high, including at SMK Negeri 1 Kokap.

A preliminary survey conducted in October 2024 at SMK Negeri 1 Kokap involved brief interviews with school staff and students. Iron tablets were distributed weekly to students following resupply from the local primary health center. The school also implemented routine health screenings, including hemoglobin testing, and provided referral letters for students identified with low hemoglobin levels. Interviews with 10 female students revealed that six reported consistent consumption of the provided iron tablets, whereas four admitted irregular intake due to forgetfulness, dislike of tablet-form medication, or adverse effects such as unpleasant odor and nausea. Based on these findings, the present study aims to investigate the association between adherence to iron tablet supplementation and anemia incidence among adolescent girls at SMK Negeri 1 Kokap, Kulon Progo.

METHODS

Study Design and Setting

This study employed a quantitative cross-sectional design. The research was conducted at SMK Negeri 1 Kokap, Kulon Progo, Indonesia, between November 2024 and February 2025.

Population and Sampling

The study population comprised all female students in grades 10 and 11 aged 15–18 years (N = 179). A total of 71 participants were selected using proportional random sampling to ensure representativeness across grade levels.

Data Collection and Measurements

Data were collected using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) and hemoglobin assessment. Hemoglobin levels were measured using the Easy Touch GCHb device. Supporting materials included informed consent forms, hemoglobin recording sheets, compliance questionnaires, documentation tools, and standard stationery for questionnaire completion.

The independent variable was adherence to iron and folic acid supplementation (IFAS). The dependent variable was anemia status. Adherence was defined as the number of iron tablets consumed regularly and appropriately within a one-month period. According to the Indonesian Ministry of Health guidelines (2018), the recommended intake for adolescent girls is at least one iron tablet per week as part of anemia prevention and control programs. Based on this recommendation, adherence was categorized as follows: adherent (≥4 tablets/month) and non-adherent (<4 tablets/month). Anemia status was determined based on hemoglobin concentration, with classification thresholds aligned with WHO criteria for adolescent girls.

Statistical Analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were generated to summarize participant characteristics. The association between iron supplementation adherence and anemia incidence was examined using the Chi-square test. Statistical significance was determined at $p < 0.05$.

Ethical Approval

This study received ethical approval from the Institutional Ethics Committee (Approval No. KEPK/UMP/45/II/2025).

RESULTS

Participant Characteristics

The characteristics of the study participants are presented in Table 1. A total of 71 adolescent girls aged 15–18 years were included, all of whom were enrolled in grades 10 and 11 at SMK Negeri 1 Kokap, Kulon Progo. The majority of participants were 16 years old (n = 31; 43.1%). Regarding grade distribution, most respondents were in grade 10 (n = 37; 52.1%), while the remainder were in grade 11.

Table 1. Characteristics of the study participants

Variable	n (71)	Percentage (%)
Age (year)		
15	27	37,5%
16	31	43,1%
17	11	15,3%
18	2	2,8%
Grade		
X	37	52,1%
XI	34	47,8%

Distribution of iron and folic acid supplementation adherence and anemia status

The distribution of iron and folic acid supplementation (IFAS) adherence and anemia status among participants is presented in Table 2. Based on self-reported questionnaire data assessing iron tablet consumption over the previous month, the majority of respondents were classified as non-adherent (93.0%), defined as consuming fewer than four tablets per month. Hemoglobin measurements indicated that 56.3% of participants were anemic (hemoglobin < 12 g/dL), while the remaining participants had normal hemoglobin levels (≥12 g/dL).

Table 2. Distribution of iron supplementation adherence and anemia status.

Variable	n (71)	Percentage (%)
IFAS Adherence		
Adherent	5	7,0
Non-adherent	66	93,0
Anemia Status		
Anemia	40	56,3
Non-anemia	31	43,7

Association between iron supplementation adherence and anemia

The association between adherence to iron and folic acid supplementation (IFAS) and anemia status is presented in Table 3. The majority of participants were classified as non-adherent (<4 tablets/month), accounting for 66 respondents (93.9%). Overall, 40 participants were identified as anemic based on hemoglobin assessment. Chi-square analysis demonstrated a statistically significant association between iron supplementation adherence and anemia status among adolescent girls at SMK Negeri 1 Kokap, Kulon Progo ($p < 0.05$).

Table 3. Association between Iron and Folic Acid Supplementation (IFAS) Adherence and Anemia Status (n = 71).

IFAS Adherence	Anemia n (%)	Non-Anemia n (%)	Total n (%)	p-Value
Adherent	0 (0.0)	5 (100.0)	5 (7.0)	
Non-adherent	40 (60.6)	26 (39.4)	66 (93.0)	0.008
Total	40 (56.3)	31 (43.7)	71 (100.0)	

DISCUSSION

Iron and folic acid supplementation (IFAS) remains a cornerstone strategy in the prevention and control of anemia, particularly among adolescent girls. However, the effectiveness of this intervention is highly dependent on adherence to regular consumption. Several factors have been reported to influence adherence, including gastrointestinal side effects such as nausea, unpleasant taste, limited awareness regarding the benefits of supplementation, and insufficient support from family members and healthcare providers (Kemenkes, 2020; Manyullei *et al*., 2024).

The present findings are consistent with previous studies demonstrating a significant association between adherence to iron supplementation and anemia status. Suaib et al. (2024) reported a statistically significant relationship between iron supplement adherence and anemia among adolescent girls ($p = 0.038$). Similarly, Savitri et al. (2021) found that higher adherence to iron tablet consumption was significantly associated with improved hemoglobin levels and reduced anemia risk. Comparable results were also reported by Alfiah and Nunung (2023) ($p = 0.001$) and Handayani and Budiman (2022) ($p =$

0.01), further supporting the role of consistent iron supplementation in reducing anemia prevalence among adolescent girls.

The iron and folic acid content of supplementation tablets plays a critical role in erythropoiesis and hemoglobin synthesis. Nevertheless, the physiological benefits can only be achieved when tablets are consumed consistently. Low adherence among adolescent girls may be attributed to sensory discomfort, inadequate knowledge regarding the importance of supplementation, and limited family and healthcare support. Therefore, anemia prevention strategies should extend beyond tablet distribution alone. Comprehensive approaches, including nutrition education, regular health promotion activities, and active engagement of schools, primary healthcare centers, and families, are essential to foster sustained behavioral change (Novaria *et al*., 2024). Such multilevel support systems may enhance adherence and ultimately contribute to reducing anemia prevalence in this vulnerable population.

In addition to inadequate iron supplementation, anemia may result from multiple contributing factors, including insufficient dietary intake of iron, folate, vitamin A, and vitamin B12; habitual consumption of tea and coffee that inhibits iron absorption; socioeconomic factors such as education and household income; and menstrual patterns. Clinical conditions such as acute or chronic inflammation, genetic disorders, parasitic infections, and impaired erythropoiesis may also interfere with hemoglobin synthesis and red blood cell production (Larasati et al., 2021; Aulya et al., 2022; Oktalia et al., 2023). These multifactorial determinants highlight the complexity of anemia etiology among adolescents.

Overall, this study demonstrates a significant association between iron supplementation adherence and anemia status. Although the proportion of participants classified as adherent was relatively small (7%), adherence data were systematically collected through assessment of iron tablet consumption over the previous month. These findings underscore the importance of strengthening adherence-focused interventions to maximize the effectiveness of anemia prevention programs among adolescent girls.

CONCLUSION

In conclusion, the majority of participants were classified as non-adherent to iron and folic acid supplementation (93%), and more than half were identified as anemic (56.3%). A statistically significant association was observed between adherence to iron supplementation and anemia status among adolescent girls at SMK Negeri 1 Kokap, Kulon Progo ($p = 0.008$). These findings underscore the importance of improving adherence to iron supplementation programs as a key strategy for reducing anemia prevalence among adolescent girls.

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